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Research Article

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Effect of tillage and nutrient management on seed cotton yield, yield contributing characters and total uptake by cotton

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Summary

The field experiment was conducted at the Research farm, Department of Soil Science and Agricultural Chemistry, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to study the effect of integrated nutrient management on soil quality and cotton productivity under different tillage practices in vertisol. The treatments thus involved two main treatments and eight sub treatments. The experiment main plot comprised of two treatments *i.e.* conservation tillage (CNS) and CNV. In which one harrowing and two weeding and in conventional tillage (CNV) one ploughing and one harrowing, two hoeing and two hand weeding operations were carried out in eight sub plot treatments of nutrient management. The seed cotton yield was slightly higher under conservation tillage as compared to conventional tillage. Highest seed cotton yield was recorded in the treatment receiving 100 % RDF (60:30:30 NPK kg ha^{-1} (15.57 q ha^{-1}) followed by 50 % RDF + 50% N (FYM) (14.84 q ha^{-1}).Significantly highest bolls per plant in conservation tillage (19.95 bolls per plant) than in CNV (17.51 bolls per plant) while bolls per plant was recorded in the treatment receiving 100 % RDF (60:30:30 NPK kg ha^{-1} (20.38 bolls per plant) followed by 50% RDF + 50% N (FYM) (T_3) (19.47 bolls per plant).Significantly higher uptake of major and micronutrients was recorded under conservation over conventional tillage. Significantly higher content of macronutrients *viz.*, N, P, K, S and Mg were recorded in the treatment receiving 100 % RDF (60:30:30 NPK kg ha^{-1}) followed by 50 % RDF + 50 % N (FYM). The total uptake of macronutrients at boll development stage was found to be significantly higher in the treatment receiving 100 % RDF (60:30:30 NPK kg ha^{-1}) followed by 50 % RDF + 50 % N (FYM). It was also noticed that the total uptake of nutrients increased from square initiation to boll development stage as the age of the crop advances towards maturity.

Key words : Conservation tillage, Yield, Uptake, Nutrient management

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Introduction

The conventional mode of agriculture through intensive agricultural practices was successful in achieving goals of production, but simultaneously led to degradation of natural resources. The growing concerns for sustainable agriculture have been seen as a positive

response to limits of both low-input, traditional agriculture and intensive modern agriculture relying on high levels of inputs for crop production. Sustainable agriculture relies on practices that help to maintain ecological equilibrium and encourage natural regenerative processes, such as nitrogen fixation, nutrient cycling, soil regeneration, and protection of natural enemies of pest and diseases as well as the targeted use of inputs. Agricultural systems relying on such approaches are not only able to support high productivity, but also preserve biodiversity and safeguard the environment. Conservation agriculture has come up as a new paradigm to achieve goal of sustained agricultural production. It is a major step toward transition to sustainable agriculture.

Conservation agriculture aims at reversing the process of degradation inherent to the conventional agricultural practices like intensive cultivation and burning and/or removal of crop residues. Aggressive seed bed preparation with heavy machinery lead to declining soil fertility, biodiversity and erosion. The nutrient needs of the Indian agriculture are so large that no single plant nutrient source be it fertilizers, organic manures, green manures or biofertilizers is in position to meet the entire plant nutrient demand. In view of the declining soil fertility and reduction in crop productivity the resource conservation becomes a top priority and restoration of precious soil resource by way of innovative means of management is the need of the day.

Cotton is the major crop grown in the vertisols of central India occupying about 5.0 106 ha. Poor soil fertility is a major cause of the low crop productivity. High risk associated with this rainfed agriculture is the major cause for the non-investment in fertilizer and/or manure. Importance of fertilizer N on the growth and yield of cotton is well known (Prasad and Prasad, 1998). Potassium is considered abundant in the cotton growing vertisols (Pasricha and Bansal, 2002) and most often is not included in the fertilizer recommendations (Tandon, 1994). Response to P has also not been consistent (Kairon *et al.*, 2002). The cotton-growing farmers, therefore, generally apply only nitrogenous fertilizers. However, application of K (Shanmugham and Bhatt, 1991) has been observed to improve fibre quality. Of late integrated nutrient management involving organic manure and chemical fertilizer has received considerable attention (Swarup *et al.*,1998). No agricultural commodity in the world exercised a profound influence on economy as cotton had done from the time immemorial. Therefore, it is popularly known as white gold. Cotton seed contains about 15-20 per cent oil and is used as vegetable oil and soap industries. After extraction of oil, the left over cake is proteinous and used as cattle feed. It is the king among the fibre crops, taking into consideration the economic impact it generates. Besides its vital role in national economy, its contribution in the foreign exchange is tremendous. Nearly one third of India's export earnings are from textile sectors of which cotton alone constitutes nearly 70 per cent of raw material. Cotton contributes 29.8 per cent of the Indian agricultural gross domestic product (Barwale *et al.*, 2004). Still there exits large potential for export of raw cotton and value added products.

Resource and Research Methods

The field experiment was carried out to study the effect of integrated nutrient management on soil quality and cotton productivity under different tillage practices in vertisol on the Research Farm of Department of Soil Science and Agricultural Chemistry, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during 2011-12 and 2012-13. Akola is situated in between 22^0 41' N latitude and 77^0 02' longitudes at an altitude of 307.4 m above mean sea level and has a subtropical climate. The climate is characterized by three distinct seasons *viz.*, summer becoming hot and dry from March to May. The two seperate experiment each in conservation and conventional tillage were conducted on same site and hence, randomization with similar set of nutrient management treatments. In conservation tillage one harrowing and two weeding operations were carried

Nutrient management treatments	
T_1	: 100% RDF (60:30:30 NPK kg ha^{-1})
T_2	: 50% RDF + In situ green manuring (sunhemp)
T_3	: 50% RDF + 50% N (FYM)
T_4	: 50% RDF + 50% N (wheat straw)
T_5	: 50% RDF + 50% N (GLM)
T_6	: 50% RDF + 25% N (FYM) + 25%N (wheat straw)
T_7	: 50% RDF + 25% N (FYM) + 25%N (GLM)
T_8	: 50% RDF + 25% N (wheat straw) + 25%N (GLM)

Different treatments consisted of balance use of chemical fertilizer along with organic source of nutrient in which 50 per cent N applied through chemical fertilizer and remaining N was applied through various sources like FYM, crop residues (wheat straw) and green manuring (sunhemp). The quantity of P and K supplied through different organics, green manuring and crop residues, the compensation remaining P and K compensated through chemical fertilizers.

every year. In conventional tillage one ploughing, one harrowing, two hoeing and two hand weeding operations were carried out every year.

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Seed cotton yield and yield contributing characters:

Seed cotton yield :

Effect of tillage :

Seed cotton yield was influenced significantly during both the seasons. The effect of tillage on seed cotton yield was found to be significant. However, in the first year slightly higher values of seed cotton yield (14.25 q ha^{-1}) were observed in conservation tillage as compared to conventional tillage (12.39 q ha^{-1}) (Table 1). In the second year higher values of seed cotton yield (15.00 q ha^{-1}) were observed in conservation tillage as compared to conventional tillage (13.07 q ha^{-1}). In pooled mean analysis higher values of seed cotton yield (14.63 q ha^{-1}) were observed in conservation tillage as compared to conventional tillage (12.73 q ha^{-1}). In vertisols, the RT systems have been reported to yield equal to or better than the CT systems (Blaise *et al*., 2005 and Constable *et al*., 1992).

Effect of nutrient management :

The seed cotton yield content varied from 11.45 to 14.82, 11.93 to 15.57 and 11.69 to 15.20 q ha^{-1} during first year, second year and pooled mean, respectively (Table 1). Seed cotton yield was influenced significantly due to integrated nutrient management. In the first year seed cotton yield (14.82 q ha^{-1}) was found significantly higher in the treatment of 100% RDF (60:30:30 NPK kg ha^{-1}) followed by, 50% N through FYM + 50% RDF(14.09 q ha^{-1}) and 50% RDF+25%N (FYM)+ 25% N (WS) (13.85 q ha^{-1}) which were found to be at par with each other. In the second year seed cotton yield (15.57 q ha^{-1}) was found significantly higher in the treatment of 100% RDF (60:30:30 NPK kg ha^{-1}) followed by, 50% N through FYM + 50% RDF(14.84 q ha^{-1}) , 50% RDF + 25% N (WS) + 25% N (GLM) (14.60 q ha^{-1}), which were found to be at par with each others. The lowest seed cotton yield (11.93 q ha^{-1}) was recorded in treatment 50% RDF+ *In situ* GM (sunhemp). In the pooled mean data seed cotton yield (15.20 q ha^{-1}) was found significantly higher in the treatment of 100% RDF (60:30:30 NPK kg ha^{-1}) followed by, 50% N through FYM + 50% RDF(14.47 q ha^{-1}) and 50%RDF+25%N (FYM)+ 25% N (WS) (14.11 q ha^{-1}) these treatment were found to be at par with each others. The lowest seed cotton yield (11.69 q ha^{-1}) was recorded in treatment 50% RDF + *In situ* GM (sunhemp). This could be ascribed to the effect of applied fertilizer and

Table 1 : Effect of tillage and nutrient management on seed cotton yield

Treatments	Seed cotton yield (q ha^{-1})		
Tillage	2011-12	2012-13	Mean
Set I :Conservation tillage	14.25	15.00	14.63
Set II :Conventional tillage	12.39	13.07	12.73
S.E.±	0.31	0.34	0.32
C.D. (P=0.05)	0.90	1.01	0.95
Nutrient management			
T_1:100% RDF (60:30:30 NPK kg ha^{-1})	14.82	15.57	15.20
T_2:50% RDF + *In situ* GM (sunhemp)	11.45	11.93	11.69
T_3:50% RDF + 50% N (FYM)	14.09	14.84	14.47
T_4:50% RDF + 50% N (WS)	13.30	14.25	13.78
T_5:50% RDF + 50% N (GLM)	11.94	12.69	12.32
T_6 :50% RDF + 25%N (FYM) + 25% N (WS)	13.85	14.36	14.11
T_7 : 50% RDF + 25% N (FYM) + 25% N (GLM)	13.61	14.6	14.10
T_8 : 50% RDF + 25% N (WS) + 25% N (GLM)	13.50	14.05	13.79
S.E.±	0.62	0.68	0.65
C.D. (P=0.05)	1.85	2.02	1.92
Interaction effect	Sig.	Sig.	Sig.

mineralization of organic sources or through solublization of the nutrients from the native sources during the process of decomposition.The interaction of conservation tillage with FYM was found most beneficial and recorded highest yield of cotton.This can be attributed to the combined effect of conservation tillage in improving soil properties along with FYM resulting into highest yield of cotton. The conservation tillage along with glyricidia green leaf manuring also recorded yields which were at par with FYM which also signifies the importance of conservation tillage with organics.This could be attributed to the intercrop competition with the cotton crop for moisture and nutrients availability throughout the crop growing period. Similar results were observed by Sethi (1988). The findings are in conformity with the results reported by Kochetkov (1976), Moursi *et al.* (1978), Patil *et al.* (1977); Selvaraj and Palaniappan (1977); Sethi (1988) and Deshmukh and Dahatonde (1999). This may be ascribed to the improvement in the soil physical, chemical and biological properties due to the incorporation of organics along with 50 per cent recommended dose of fertilizers which might have hastened the nutrient availability as well as better soil condition for root penetration. The results are in close agreement with the findings reported by Subramanian *et al.* (2000).

Bolls per plant :

The data regarding the effect of tillage and nutrient management in combination with inorganic fertilizers on bolls per plant are presented in Table 2.

Effect of tillage :

Data indicated that bolls per plant were significantly influenced with tillage during both the years of experimentation. Bolls per plant was influenced significantly during both the seasons. The effect of tillage on bolls per plant was found to be significant. However, in the first year slightly higher of bolls per plant (15.50 bolls per plant) were recorded in conservation tillage as compared to conventional tillage (13.57 bolls per plant). In the second year higher values of bolls per plant (19.95 bolls per plant) were observed in conservation tillage as compared to conventional tillage (17.51 bolls per plant). In pooled mean analysis higher values of bolls per plant (17.71 bolls per plant) were observed in conservation tillage as compared to conventional tillage (15.53 bolls per plant). Total harvestable boll numbers were significantly affected by tillage systems, differences between treatments were not significant treatment. Reduced tillage produced 62.3 bolls and was significantly greater than the number of bolls produced on the CT plots 58.9 bolls. Significantly higher bolls produced on the RT plots were observed in an earlier study with the upland cotton (Blaise and Ravindran, 2003).

The treatment of organics recorded significantly higher bolls per plant during both the seasons of study.

Table 2 : Effect of tillage and nutrient management on number of bolls

Treatments	No. of bolls/plant		
Tillage	2011-12	2012-13	Pooled
Set I :Conservation tillage	15.50	19.95	17.71
Set II :Conventional tillage	13.57	17.51	15.53
S.E. ±	0.33	0.35	0.34
C.D. (P=0.05)	0.98	1.04	1.02
Nutrient management			
T_1:100% RDF (60:30:30 NPK kg ha^{-1})	16.07	20.38	18.20
T_2:50% RDF + *In situ* GM (sunhemp)	12.43	16.87	14.62
T_3:50% RDF + 50% N (FYM)	15.34	19.47	17.39
T_4:50% RDF + 50% N (WS)	14.55	19.13	16.83
T_5:50% RDF + 50% N (GLM)	13.19	17.63	15.40
T_6 :50% RDF + 25%N (FYM) + 25% N (WS)	15.10	19.41	17.24
T_7 : 50% RDF + 25% N (FYM) + 25% N (GLM)	14.86	19.37	17.11
T_8 : 50% RDF + 25% N (WS) + 25% N (GLM)	14.75	19.21	16.97
S.E.±	0.65	0.70	0.68
C.D. (P=0.05)	1.95	2.08	2.03
Interaction effect	Sig.	Sig.	Sig.

Table 3 : Effect of tillage and nutrient management on macronutrients (N, P, K, S and Mg) total uptake in different plant parts of cotton at square initiationstage

Treatments	Total uptake of nutrients (kg ha^{-1})														
	Nitrogen			Phosphorus			Potassium			Sulphur			Magnesium		
Tillage	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
Set I : Conservation tillage	18.83	20.43	19.63	7.86	8.69	8.28	19.06	20.67	19.87	7.99	8.81	8.4	6.02	6.71	6.37
Set II : Conventional tillage	17.44	19.15	18.28	7.19	8.04	7.61	17.57	19.41	18.48	7.3	8.18	7.74	5.47	6.19	5.82
S.E.±	1.18	1.22	1.19	0.51	0.57	0.54	1.06	1.13	1.07	0.55	0.59	0.58	0.47	0.53	0.50
C.D. (P=0.05)	3.10	3.47	3.26	1.50	1.63	1.60	3.02	3.24	3.12	1.53	1.67	1.61	1.36	1.57	1.49
Nutrient management															
T_1 : 100% RDF (60:30:30 NPK kg ha^{-1})	19.75	21.5	20.63	8.41	9.31	8.86	20.02	21.77	20.89	8.53	9.45	9	6.51	7.26	6.89
T_2 :50% RDF+ *In situ* GM (sunhemp)	16.67	18.19	17.43	6.77	7.52	7.14	16.89	18.42	17.66	6.92	7.66	7.29	5.09	5.71	5.4
T_3 : 50% RDF + 50% N (FYM)	19.1	20.85	19.97	8.04	8.94	8.49	19.23	21.11	20.17	8.16	9.07	8.61	6.2	6.94	6.56
T_4 : 50% RDF + 50% N (WS)	17.41	19.03	18.22	7.13	7.93	7.53	17.55	19.26	18.41	7.24	8.06	7.65	5.41	6.08	5.73
T_5 : 50% RDF + 50% N (GLM)	17.02	18.63	17.82	6.96	7.76	7.35	17.23	18.85	18.04	7.07	7.86	7.47	5.25	5.9	5.58
T_6 :50% RDF + 25%N (FYM) + 25% N (WS)	18.8	20.57	19.68	7.87	8.77	8.33	18.93	20.82	19.87	7.99	8.92	8.45	6.05	6.81	6.43
T_7 : 50% RDF + 25% N (FYM) + 25% N (GLM)	18.41	20.06	19.23	7.66	8.49	8.07	18.53	20.32	19.42	7.76	8.62	8.19	5.86	6.55	6.21
T_8 : 50% RDF + 25% N (WS) + 25% N (GLM)	17.91	19.52	18.73	7.39	8.21	7.8	18.13	19.75	18.94	7.45	8.33	7.89	5.64	6.31	5.99
S.E.±	1.44	1.47	1.45	0.67	0.70	0.68	1.71	1.27	1.49	0.71	0.74	0.73	0.53	0.68	0.61
C.D. (P=0.05)	3.57	3.68	3.62	1.93	2.02	1.99	4.95	3.74	4.51	2.04	2.17	2.11	1.55	1.79	1.68
Interaction effect	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS= Non-significant

The pooled data also revealed that reduced tillage increased the bolls per plant beneficial forrainfed condition. This can be ascribed to the higher availability of moisture in the treatment at critical growth stages which also increased the availability of plant nutrients in the soil. The findings are in consonance with the results reported by Sethi (1988); Deshmukh and Dahatonde (1999); Deshmukh *et al.* (2004); Patil *et al.* (2004); Pettigrew (2004) and Hulihalli and Patil (2006).

Effect of nutrient management :

The bolls per plant were significantly influenced during both the years of investigation. It is evident from the results that number of bolls varied from 12.43 to 16.07 and 16.87 to 20.38 during first and second year, respectively. The pooled observed to be varied from 14.62 to 18.20 bolls per plant. Bolls per plant was influenced significantly due to integrated nutrient management. In the first year bolls per plant (16.07 bolls per plant) was found significantly higher in the treatment of 100% RDF (60:30:30 NPK kg ha^{-1}) followed by, 50% N through FYM + 50% RDF (15.34 bolls per plant) and 50% RDF +25%N (FYM)+ 25% N (WS) (15.10 bolls per plant), these treatment were found to be at par with each others. The lowest bolls per plant (12.43 bolls per plant) was recorded in treatment 50% RDF+ *In situ* GM (sunhemp). In the second year bolls per plant (20.38 bolls per plant) was found significantly higher in the treatment of 100 % RDF (60:30:30 NPK kg ha^{-1}) followed by, 50% N through FYM + 50% RDF (19.47 bolls per plant), 50% RDF + 25% N (WS) + 25% N (GLM) (19.41bolls per plant), which were found to be at par with each others. The lowest bolls per plant (16.87bolls per plant) was recorded in treatment 50% RDF + *In situ* GM (sunhemp). In the pooled mean data bolls per plant (18.20 bolls per plant) was found significantly higher in the treatment of 100% RDF (60:30:30 NPK kg ha^{-1}) followed by, 50% N through FYM + 50% RDF(17.39 bolls per plant) and 50% RDF

Table 4 : Effect of tillage and nutrient management on macronutrients (N, P, K, S and Mg) total uptake in different plant parts of cotton at boll development stage

Treatments	Total uptake of nutrients (kg ha^{-1})														
Tillage	Nitrogen			Phosphorus			Potassium			Sulphur			Magnesium		
	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
Set I : Conservation tillage	56.51	59.09	57.79	26.38	28.06	27.21	57.39	60.01	58.69	26.55	28.21	27.38	18.44	19.89	19.17
Set II : Conventional tillage	53.84	57.46	55.56	24.2	26.99	25.6	54.8	58.48	56.64	25.06	27.15	26.1	17.25	18.95	18.1
S.E.=	1.02	1.23	1.18	0.64	0.68	0.65	0.83	0.87	0.85	0.67	0.71	0.68	0.49	0.51	0.46
C.D. (P=0.05)	3.07	3.87	3.47	1.38	1.46	1.43	2.27	2.49	2.4	1.49	1.88	1.57	1.29	1.47	1.36
Nutrient management															
T_1 : 100% RDF (60:30:30 NPK kg ha^{-1})	57.61	60.6	59.1	26.99	29.17	28.07	58.57	61.54	60.06	27.48	29.32	28.41	19.36	20.92	20.14
T_2 :50% RDF + *In situ* GM (sunhemp)	52.98	55.52	54.22	23.91	25.76	24.84	53.86	56.43	55.14	24.34	25.92	25.12	16.55	17.89	17.22
T_3 : 50% RDF + 50% N (FYM)	56.68	59.78	58.23	26.31	28.55	27.42	57.62	60.73	59.17	26.81	28.7	27.75	18.78	20.36	19.56
T_4 : 50% RDF+50% N (WS)	54.18	57.43	55.8	24.45	26.73	25.6	55.09	58.36	56.72	24.98	26.89	25.93	17.06	18.66	17.86
T_5 : 50% RDF + 50% N (GLM)	53.7	56.65	55.18	24.32	26.41	25.37	54.61	57.56	56.08	24.82	26.57	25.69	16.94	18.41	17.68
T_6 :50% RDF + 25%N (FYM) + 25% N (WS)	56.15	59.38	57.76	25.99	28.28	27.14	57.1	60.32	58.7	26.51	28.45	27.48	18.51	20.13	19.31
T_7 : 50% RDF + 25% N (FYM) + 25% N (GLM)	55.35	58.5	56.92	25.42	27.81	26.61	56.25	59.74	57.99	25.94	27.97	26.95	17.99	19.68	18.83
T_8 : 50% RDF + 25% N (WS) + 25% N (GLM)	54.78	58.29	56.53	24.95	27.45	26.19	55.68	59.2	57.44	25.52	27.6	26.57	17.56	19.35	18.46
S.E.=	2.10	2.24	2.18	0.72	0.76	0.74	1.47	1.53	1.49	0.78	0.89	0.83	0.63	0.59	0.62
C.D. (P=0.05)	6.17	6.77	6.45	2.11	2.33	2.23	4.60	4.67	4.54	2.29	2.86	2.74	1.72	1.78	1.74
Interaction effect	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS= Non-significant

+ 25 % N (FYM)+ 25% N (WS) (17.24 bolls per plant). The lowest bolls per plant (14.62 bolls per plant) was recorded in treatment 50% RDF + *In situ* GM (sunhemp). This could be attributed to the effect of applied fertilizer and mineralization of organic sources or through solublization of the nutrients from the native sources during the process of decomposition. Sethi (1988) also reported the similar findings.

This can be justified further in view of readily available nutrients at RDF during the first year of experimentation and efficient nitrogen use. However, wheat straw did not record desirable results due to its wider C:N ratio. The results of present investigation on number of bolls per plant are in conformity with the findings by Awasya *et al.* (2006); Bhalerao *et al.* (2007) and Mehta *et al.* (2009). The results commensurate with the findings reported by Basavanneppa and Biradar (2002); Babalad and Itnal (2004), Hongal *et al.* (2004) and Bhalerao *et al.* (2007).

Total uptake of macronutrients (N, P, K, S and Mg) :

The data on total uptake in cotton at square initiation, boll development and harvest stages are reported in Table 3-5.

Effect of tillage :

The pooled results indicated that the total uptake at square initiation stage ranged from 18.28 to 19.63, 7.61 to 8.28 and 18.48 to 19.87, 7.74 to 8.40 and 5.82 to 6.37 (N, P, K, S and Mg) kg ha^{-1} whereas in the boll development stage it was ranged from 55.66 to 57.79, 25.60 to 27.21 and 56.64 to 58.69, 26.10 to 27.38 and 18.10 to 19.17 (N, P, K, S and Mg) kg ha^{-1}, respectively and in the

Table 5 : Effect of tillage and nutrient management on macronutrients (N, P, K, S and Mg) total uptake in different plant parts of cotton at harvest stage

Treatments	Total uptake of nutrients (kg ha^{-1})														
Tillage	Nitrogen			Phosphorus			Potassium			Sulphur			Magnesium		
	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
Set I : Conservation tillage	28.45	32.9	30.67	11.46	13.92	12.69	32.8	37.34	35.06	13.4	15.63	14.52	10.34	12.35	11.34
Set II : Conventional tillage	27.33	31.96	29.65	10.79	13.17	11.98	31.65	36.24	33.94	12.62	14.87	13.75	9.66	11.67	10.68
S.E.±	1.19	1.27	1.28	0.54	0.62	0.56	1.21	1.33	1.22	0.63	0.67	0.64	0.43	0.47	0.45
C.D.(P=0.05)	3.24	3.44	3.35	1.46	1.64	1.57	3.19	3.77	3.50	1.67	1.73	1.70	1.36	1.52	1.45
Nutrient management															
T_1 : 100% RDF (60:30:30 NPK kg ha^{-1})	32.09	35.78	33.93	13.31	15.43	14.37	36.72	40.15	38.44	15.6	17.42	16.51	12.43	14.18	13.31
T_2 .50% RDF + *In situ* GM (sunhemp)	24.58	30	27.29	9.56	12.33	10.94	28.92	34.49	31.7	10.75	13.31	12.03	8.39	10.59	9.49
T_3 : 50% RDF + 50% N (FYM)	30.1	34.34	32.21	12.3	14.64	13.47	34.61	38.74	36.68	14.4	16.5	15.45	11.2	13.14	12.17
T_4 : 50% RDF + 50% N (WS)	26.24	30.76	28.5	10.13	12.5	11.31	30.5	35.17	32.85	11.97	14.21	13.09	8.96	10.94	9.95
T_5 : 50% RDF + 50% N (GLM)	26.62	31.43	29.02	10.34	12.83	11.59	30.71	35.56	33.15	12.1	14.46	13.29	9.00	11.04	10.02
T_6 :50% RDF + 25%N (FYM) + 25% N (WS)	29.15	33.49	31.31	11.8	14.15	12.97	33.53	37.79	35.67	13.81	15.96	14.89	10.75	12.71	11.73
T_7 : 50% RDF + 25% N (FYM) + 25% N (GLM)	27.57	32.34	29.96	11.02	13.52	12.27	31.73	36.54	34.14	12.97	15.35	14.16	10.01	12.11	11.06
T_8 : 50% RDF + 25% N (WS) + 25% N (GLM)	26.68	31.32	29	10.57	13.02	11.8	31.03	35.81	33.42	12.46	14.8	13.63	9.26	11.4	10.32
S.E.±	1.44	1.48	1.45	0.59	0.64	0.63	1.61	1.66	1.63	0.69	0.73	0.70	0.52	0.56	0.55
C.D. (P=0.05)	4.72	4.87	4.78	1.79	1.86	1.82	4.85	4.99	4.71	1.82	1.90	1.85	1.64	1.66	1.63
Interaction effect	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS= Non-significant

harvest stage it ranged from 29.65 to 30.67, 11.98 to 12.69 and 33.94 to 35.06, 13.75 to 14.52 and 10.68 to 11.34 (N, P, K, S and Mg) kg ha^{-1}, respectively. The total uptake of (N, P, K, S and Mg) during square initiation, boll development and harvest stage was influenced significantly. The highest total uptake recorded in conservation tillage as compared to conventional tillage. This can be ascribed to the immediate availability of readily assimilable form of nutrients in fertilizer treatment by plants. Similar findings were reported by Nehra (2006); Patil *et al.* (2000) and Tomar (2005).

Effect of nutrient management :

The pooled results indicated that the total uptake at square initiation stage ranged from 17.43 to 20.63, 7.14 to 8.86, 17.66 to 20.89, 7.29 to 9.00 and 5.40 to 6.89 (N, P, K, S and Mg) kg ha^{-1} whereas in the boll development stage it ranged from 54.22 to 59.10, 24.84 to 28.07 and 55.14 to 60.06, 25.12 to 28.41 and 17.22 to 20.14 (N, P, K, S and Mg) kg ha^{-1}, respectively and in the harvest stage it ranged from 27.29 to 33.93, 10.94 to 14.37, 31.70 to 38.44, 12.03 to 16.51 and 9.49 to 13.31(N, P, K, S and Mg) kg ha^{-1}, respectively. The total uptake of (N, P, K, S and Mg) during square initiation, boll development and harvest stage was influenced significantly during the study. The significantly highest total uptake recorded in 100% RDF (60:30:30 NPK kg ha^{-1}). It may be ascribed to efficient utilization of and assimilation of macronutrients in cotton plant at boll development stage in turn increasing the nutrient uptake and ultimately the seed cotton yield. The scrutiny of the data showed that the uptake of these nutrients increased with advancement of age towards the maturity of the cotton crop. The findings are in line with the results reported by Rao and Tak (2001) and Katkar (2008).

Literature Cited

Awasya, H.L., Johnson, P.L., Sarawgi, S.K., Nanda, H.C. and Kulkarni, A. (2006). Integrated nutrient management in upland cotton (*Gossypium hirsutam* L.) under vertisols of Chhattisgarh. *J. Agril.* ,**11**(2) : 67-70.

Bablad, H.B and Itnal, C.J. (2004). Integrated nutrient management in cotton and soybean inter cropping system on vertic inceptisols under rainfed condition. In : International symposium on " Strategies for sustainable, 2. Crop Production – A global vision" 23-25, Nov. 2004, University of Agricultural Sciences, Dharwad (Karnataka) India: 92-97pp.

Basavanneppa, M.A. and Biradar, D.P. (2002). Effect of integrated nutrient management practices on the production of cotton-maize-bengal gram sequence under irrigated ecosystem in Tungabhadra project area. *J. Cotton Res. Dev.*, **16** (2) : 125-129.

Bhalerao, P.D., Patil, B.R., Katkar, R.N. and Ghatol, P.U. (2007). Effect of integrated nutrient management on seed cotton yield and economics of hybrid cotton. *PKV Res. J.*, **31**(2) : 259-262.

Blaise, D. and Ravindran, C.D. (2003). Yield of cotton grown on a vertisol over 5 years in a semi-arid region of India. *Soil & Till. Res.*, **70** : 163–173.

Blaise, D., Majumdar, G. and Tekale, K.U. (2005). On-farm evaluation of fertilizer application and conservation tillage on productivity of cotton + pigeonpea strip intercropping on rainfed vertisols of central India. *Soil & Till. Res.*, **84** : 108–117.

Constable, G.A., Rochesrer, I.J. and Daniells, I.G. (1992). Cotton yield and nitrogen requirement as modified by crop rotation and tillage method. *Soil & Till. Res.*, **23** : 41-59.

Deshmukh, A.V. and Dahatonde, B.N. (1999). Water use studies in pre-monsoon hybrid cotton as affected by moisture regimes and plant density under drip irrigation. *Ann. Plant Physiol.*, **13** (2) : 190-191.

Deshmukh, R.K., Rao, M.R.K., Rajendran, T.P., Meshram, M.K. and Santhy, V. (2004). Seed cotton yield and quality as influenced by irrigation management in cotton. In: International symposium on " Strategies for sustainable cotton production – A global vision" 2. Crop Production, 23-25, Nov. 2004, University of Agricultural Sciences, Dharwad (Karnataka) India: 253pp.

Hongal, M.M., Chittapur, B.M. and Nooli, S.S. (2004). Effect of green manures and nitrogen levels on the performance of cotton in chilli+cotton intercropping system. In: International symposium on " Strategies for sustainable cotton production – A global vision" 2. Crop Production, 23-25, Nov. 2004, University of Agricultural Sciences, Dharwad (Karnataka) India 181-184pp.

Hulihalli, U.K. and Patil, V.C. (2006). Effect of integrated nutrient management practices on yield and nutrient uptake by cotton. *PKV Res. J.*, **30** (2) : 146-150.

Kairon, M.S., Blaise, D. and Venugopalan, M.V. (2002). Cotton, In : Prasad, R. (Ed,) *Text book of field crops production*, Indian Council of Agricultural Research, New Delhi, India, 646-674pp.

Katkar, R.N. (2008). Effect of crop residue management and moisture regimes on soil properties, plant growth, seed cotton yield, water use efficiency and fibre quality Ph.D Thesis, Dr.

Panjabrao Deshmukh Krishi Vidyapeeth Akola, M.S.(INDIA).

Kochetkov, V.V. (1976). Effect of different pre irrigation soil moisture contents on flower and boll formation and shedding in cotton cv. TASHKENT-1. Sbornik nauchnykh trudov Andizhan skogofiliala Soyuz NIKhI., 100-106pp.

Moursi, M.A., Din, E.l., Salam, A.M. and Hussein, M.M. (1978). Effect of available soil moisture on cotton plant. 3. Effect on dry matter content and yield. *Egyptian J. Agron.*, **3**(1): 99-108.

Pasricha, N.S. and Bansal, S.K. (2002). Potassium fertility of Indian benchmark soils. In: Pasricha, N.S., Bansal, S.K., (Eds.), *Potassium for sustainable crop production*. International Potash Institute, Basel, Switzerland and Potash Research Institute of India, Gurgaon, Haryana, India, pp. 124–150.

Patil, B.C., Adarsha, T.S. and Kareekatti, S.R. (2004). Growth phenology and yield of hybrid cotton as influenced by nutrient and moisture regimes. In International symposium on "Strategies for sustainable cotton production – A global vision" 2. Crop Production, 23-25, Nov. 2004, University of Agricultural Sciences, Dharwad (Karnataka) India, 369-372pp.

Patil, S.L., Sheelavantar, M. N. and Surkod, V. S. (2000). Grain yield and economics of *Rabi* sorghum as influenced by *in situ* moisture conservation practices and integrated nutrient management in semi-arid vertisols. *Indian J. Dryland Agric. Res & Dev.*, **15** (2) : 98-103.

Patil, V.S., Ansari, M.R., Reddy, M.R. and Panchal, Y.C. (1977). Effect of soil moisture regimes, nitrogen levels and skip row planting on yield and water use efficiency of cotton. *Mysore J. Agril. Sci.*, **11** (4) : 481-485.

Pettigrew, W.T. (2004). Moisture deficit effects on cotton lint yield, yield components and boll distribution. *Agron. J.*, **96** (2) : 377 - 383.

Prasad, M. and Prasad, R. (1998). Nutrient management in cotton (*Gossypium hirsutum*). *Indian J. Agron.*, **43** : 162–164.

Rao, A.V. and Tak, Richa (2001). Influence of organic amendments on the growth of different trees and nutrient uptake in gypsum minespoils. *J. Indian Soc. Soil Sci.*, **49**(2) : 386-390.

Selvaraj, K.V. and Palaniappan, S.P. (1977). Studies on root growth and penetration of cotton in relation to soil strength and moisture regimes. *Curr. Res.*, **6** (1) :10-11.

Sethi, H.N. (1988). Studies on biomass production and water use efficiency of cotton varieties as influenced by intercrops and irrigation levels. Ph.D Thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, M.S.(INDIA).

Shanmugam, K. and Bhatt, J.G. (1991). Effect of potassium on fibre properties of high quality cotton varieties. *J. Indian Soc. Cotton Improv.*, **16**: 31-15.

Subramanian, S., Rajeswari, M. and Chitdeswari, T. (2000). Effect of organic fertilizers on soil moisture conservation in rainfed vertisol. *Madras Agril. J.*, **87** (4-6) : 345-347.

Swarup, A., Reddy, D.D. and Prasad, R. N. (1998). *Long-term fertility management through integrated plant nutrient supply system*. Indian Institute of Soil Science, Bhopal (M.P.) INDIA.

Tandon, H.L.S. (1994). *Fertilizers and integrated nutrient recommendations for balance and efficiency*. Fertilizer Development and Consultation Organization, NEW DELHI, INDIA.

Tomar,R.S. (2005). Productivity of upland cotton (*Gossypium hirsutum*) genotypes under different levels of fertility and spacing. *Indian J.Agron.*, **45** (4) : 776-777.

Webliography

Barwale, R.B., Gadwal, V.R., Zehr, U. and Zehr, B. (2004). Prospects for Bt cotton technology in India. *Ag. Bio. Forum.*, **7**(1&2) : 23-26. *Available on the World Wide Web: http:// www.agbioforum.org.*

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